OFFICE OF NAVAL RESEARCH
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CONSTANT PRESSURE ADJUSTABLE FLOW PUMP

Francis R. Racki

Westinghouse Electric Corp., Pittsburgh, PA

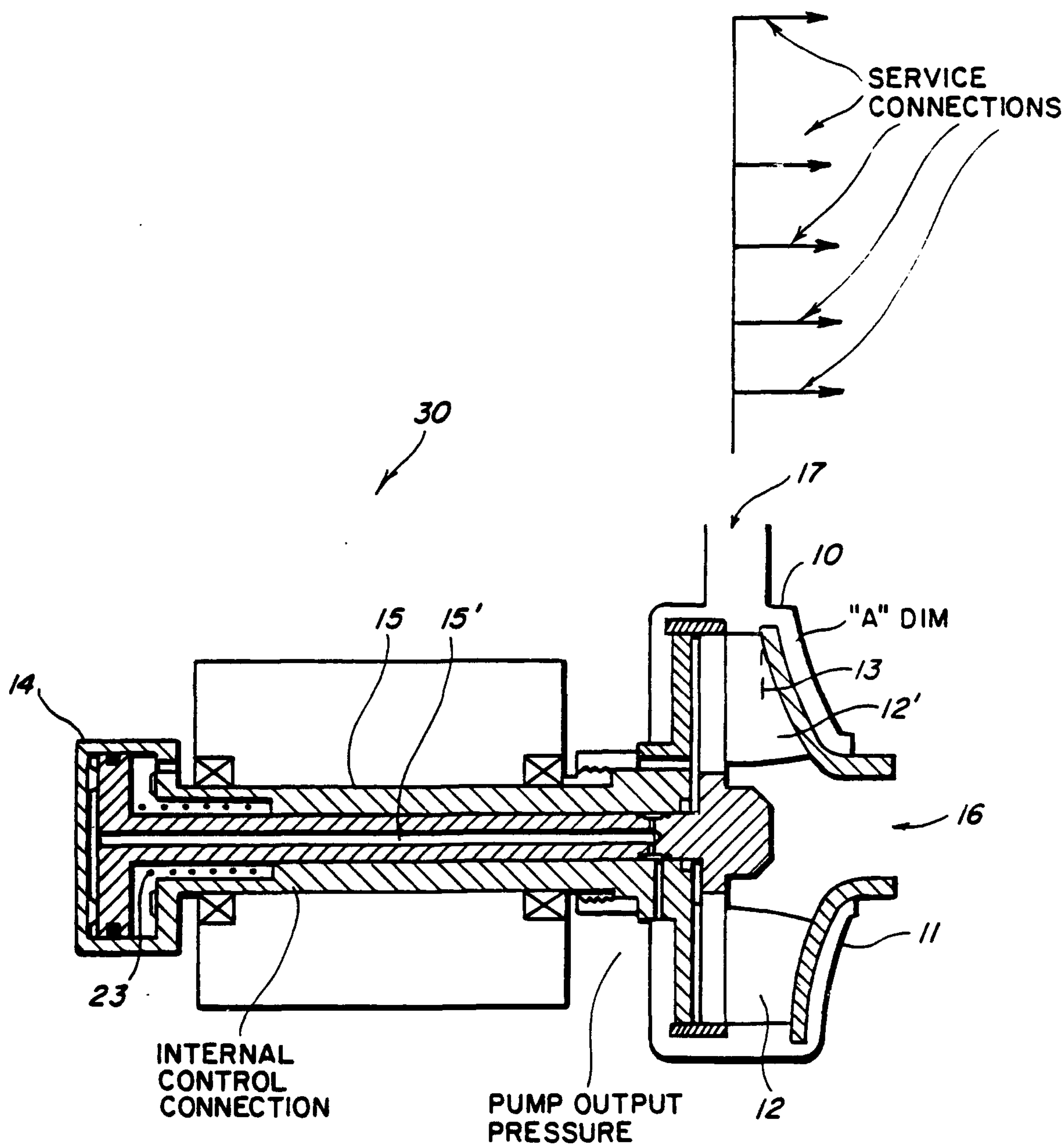

FIG. 1

Navy Tech. Cat. No. 5480 Navy Case No. 71070

CONSTANT PRESSURE ADJUSTABLE FLOW PUMP

Francis R. Racki

Westinghouse Electric Corp., Pittsburgh, PA

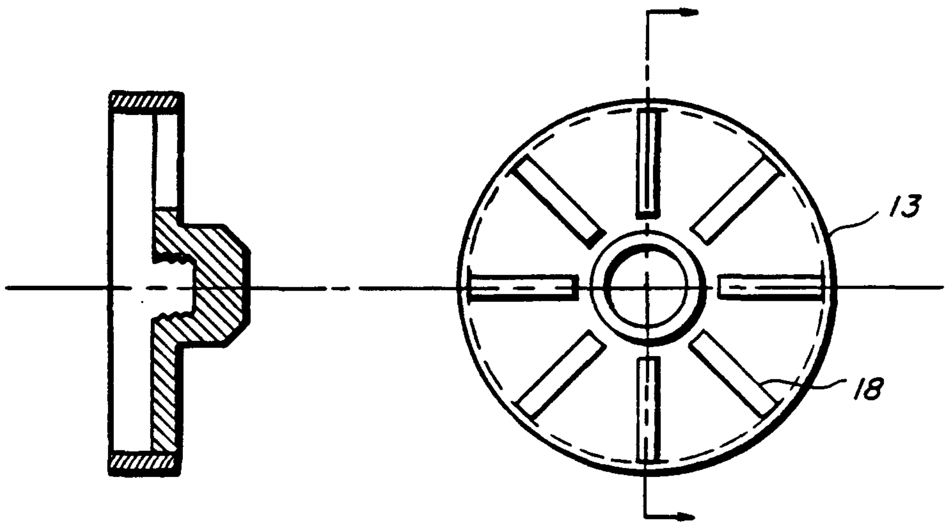

FIG. 2

CONSTANT PRESSURE ADJUSTABLE FLOW PUMP

Francis R. Racki

Westinghouse Electric Corp., Pittsburgh, PA

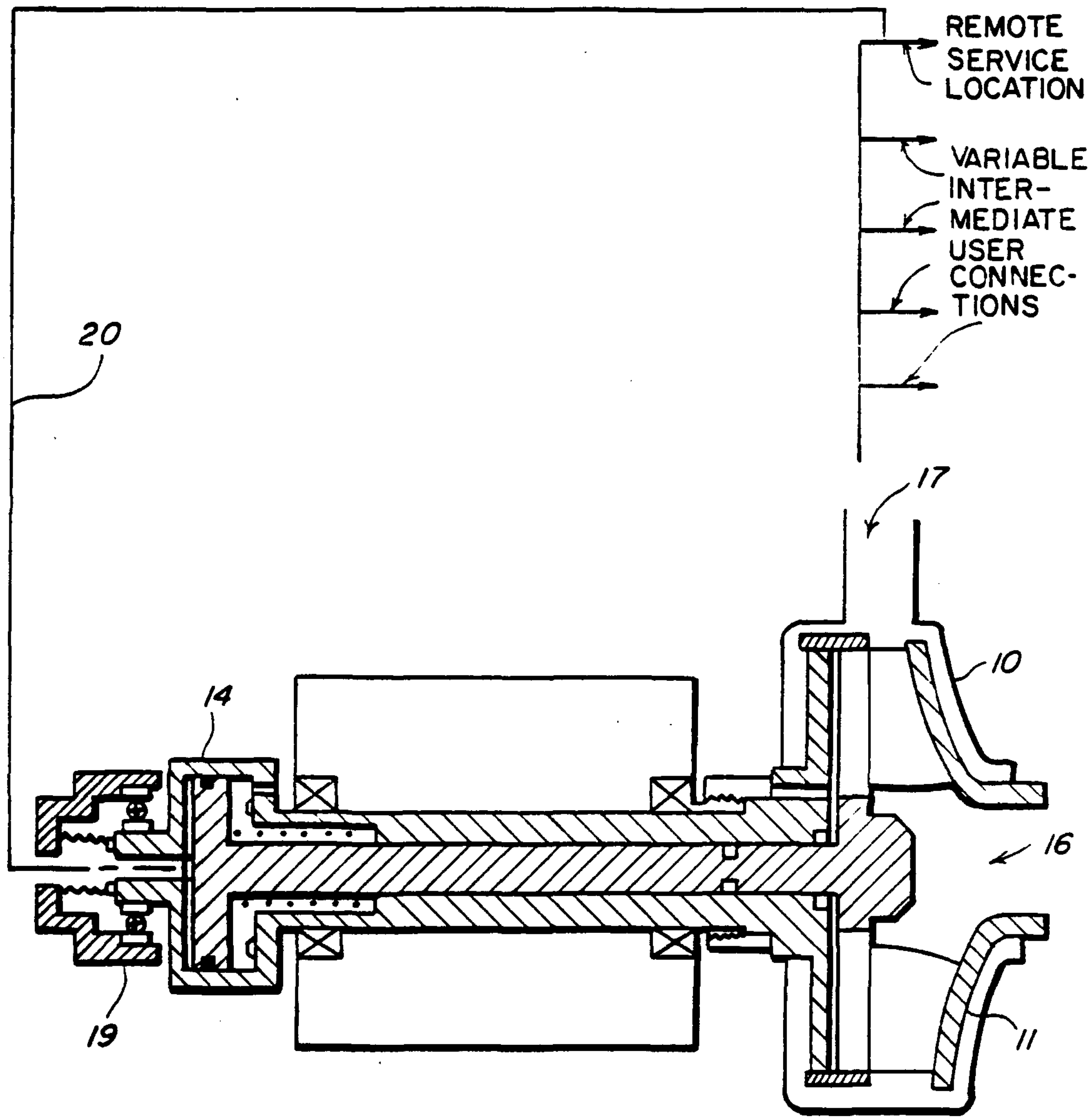

FIG. 3

Constant Pressure Adjustable Flow Pump

Francis R. Racki

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ABSTRACT

An adjustable flow pump which automatically maintains a required constant pressure under variable demand conditions. The pressure can be maintained as a constant either at the pump output or at a remote service connection. The flow of the pump can be varied to meet the variable demand by varying the axial position of an impeller back plate and the width of the pump's impeller thus controlling the volume of fluid passing through the impeller while maintaining a constant output pressure.

DESCRIPTION

Figure 1 illustrates in cross-section an adjustable flow pump 30 comprising a housing 10 having an axis and provided with an impeller 11 rotatably disposed within the housing for rotation about the axis. The housing is provided with a fluid inlet 16 circumferentially positioned about the housing axis and a fluid outlet 17 positioned radially outward of fluid inlet 16. Impeller 11 is constructed with a plurality of curved vanes 12 and 12', of which only two are illustrated, and an adjustable impeller back plate 13 which is held in position by control piston 14. As shown in Figure 2, adjustable back plate 13 is constructed with slotted openings 18 to permit axial motion relative to impeller vanes 12. Impeller back plate 13 is connected by control piston 14 through a hollow motor shaft 15 with a hollow space 15'. Both adjustable back plate 13 and control piston 14 are coaxial with the impeller axis and rotate within the housing as a unit. The width (i.e. axial length) of impeller 11, which controls the cross-sectional flow area, is adjusted by varying the axial position of the adjustable back plate relative to vanes 12 and 12', illustrated in Figure 1 by dimension A.

After the pump is operating and a desired constant pressure is obtained dependent upon the speed of the pump, the pump automatically adjusts flow to maintain a uniform output pressure as follows. Initially, impeller back plate 13 is positioned by the force spring 23 acting on control piston 14 and the impeller's width is at its maximum. As the pumped fluid from the pump output flows through hollow space 15' and acts against control piston 14, the piston responds to changes in pump output pressure, thereby varying the axial position of adjustable back plate 13 and fluid flow through the pump to maintain a constant output pressure.

With specific reference to Figure 3, feedback pressure from a remote location can be used as the control connection, whereby the adjustable flow pump maintains a constant pressure at that service location. Feedback control line 20 is externally connected to the control piston 14 through a rotating seal 19. The pump flow is continuously adjusted to maintain a fixed pressure at the remote service location regardless of variable demand conditions imposed by other intermediate users.

ADVANTAGES and FEATURES

The adjustable flow pump uses an adjustable impeller back plate to maintain a constant pressure under variable demand conditions. The pressure can be controlled to minimize losses over the range of pump output flows. When controlled to produce a constant output pressure, the adjustable flow pump avoids overpressurization and erosive flow problems in the piping during low demand conditions. When controlled to produce a constant pressure at a remote service location, the adjustable flow pump maintains a constant pressure at that location regardless of the number of intermediate users.

Navy Tech. Cat. Nos. 1130, 3830 Navy Case No. 71169

CRANKSHAFT COUPLING FOR MULTIROTOR ROTARY ENGINE

Mohibul Hoque
Bronko Terkovich

John Deere Technologies International, Inc. REDIV, Woodridge, NJ

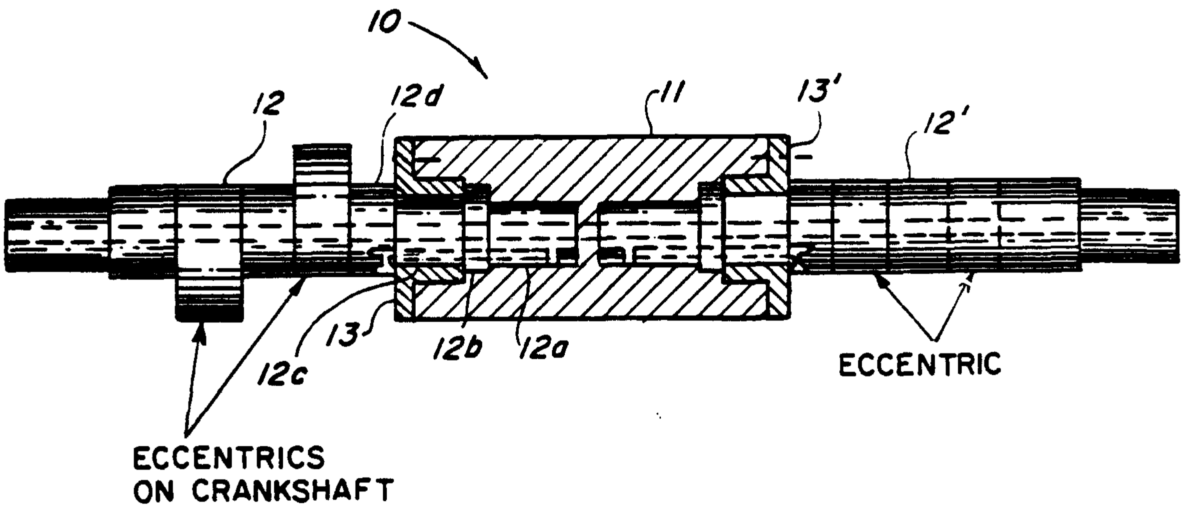

FIG. 1

Navy Tech. Cat. No. 1130 3830 Navy Case No. 71169

CRANKSHAFT COUPLING FOR MULTIROTOR ROTARY ENGINE

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John Deere Technologies International, Inc.
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Abstract

Engine module shafts are connected by a polygon-type coupling. The coupling is adapted to allow for some degree of misalignment between shafts and to provide a greater torque capacity. The coupling incorporates a split flanged collar positioned on a groove of each module shaft adjacent to the coupling sleeve to transmit torque.

Description

Couplings for use with rotating shafts are classified by the type of alignment and centerline position of the connecting shafts. Rigid couplings are used for shafts where the axes are directly in line. Flexible couplings are used where the axes may be at a slight angle and slightly displaced.

The sole figure illustrates a coupling 10 consisting of a sleeve 11, with polygon-shaped internal openings at opposite ends for receiving axially spaced shafts 12 and 12'. Shaft 12 is comprised of an end shaft member 12a, which is polygonal in cross section, an enlarged central shaft member 12b forming a shoulder, a reduced shaft member 12c, and an end shaft member 12d. Shaft members 12b and 12c are grooved to accommodate a split flanged collar 13.

When a rigid connection is desired, there is a small interference between shaft 12 and the internal opening in sleeve 11 and more interference between sleeve 11 and collar 13. Shafts 12 and 12' are installed under oil pressure, which is released once collar 13 is bolted to sleeve 11, whereby sleeve 11 compresses shaft 12, preventing relative rotary and axial motion of the shafts.

When a flexible connection is desired, flexible couplings are used which comprise polygon-shaped members on each end of the joined shafts and a flexible connecting member with polygon-shaped internal openings to receive the shafts.

Advantages and Features

The engine module coupling uses a split flanged collar adjacent to a sleeve to accommodate either a rigid connection or a flexible connection. The flexible polygon coupling is capable of transmitting the necessary torques imposed by a range of engine types. The rigid polygon coupling is inexpensive without increasing the overall length. The coupling's ability to adapt to either connection after suitable modifications allows for easy assembly and disassembly.

FABRICATION PROCESS FOR OVERMODED WAVEGUIDE

William T. Howarth

Johns Hopkins University, APL, Laurel, MD

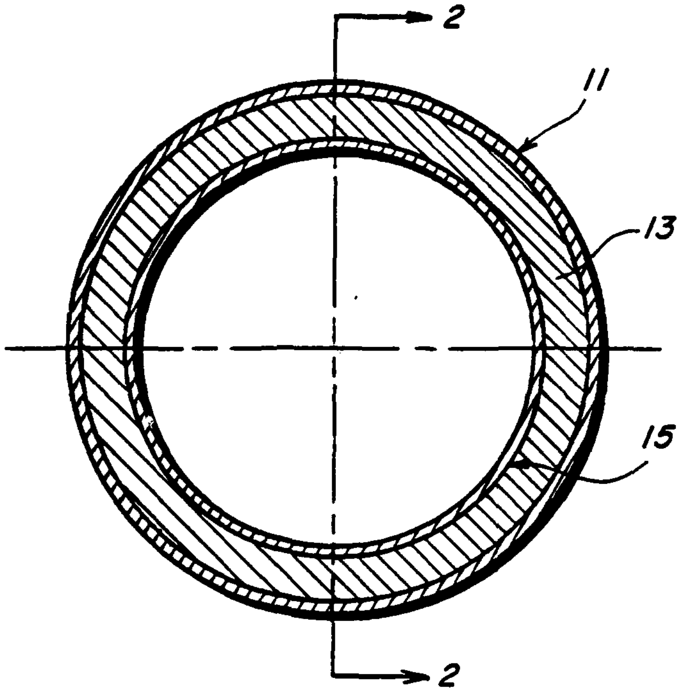

FIG. 1

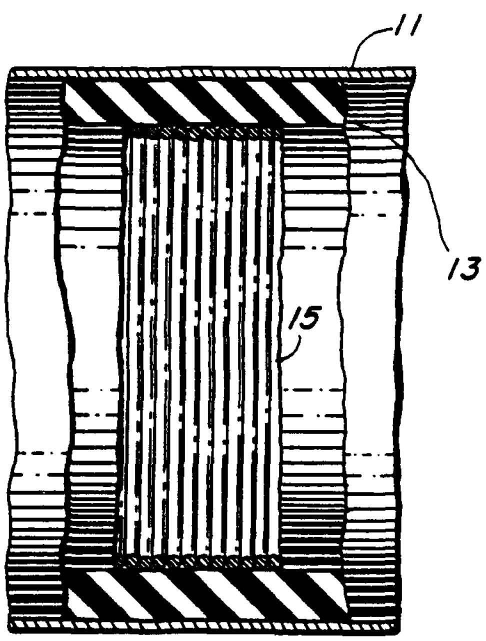

FIG. 2

FABRICATION PROCESS FOR OVERMODED WAVEGUIDE

William T. Howarth
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Abstract

A fabrication process for a high power overmoded helix "S" band waveguide was developed. An overmoded waveguide has its goal to transport high levels of pure mode microwave power without propagating unwanted modes. Circular conductive paths formed on the inner conductor of the waveguide suppress the development and propagation of unwanted modes. In the present process, insulated helically wound continuous wire is used to accomplish the circular conductive paths.

Description

A cross section of an overmoded waveguide is shown in Figure 1, having a ground plane aluminum cylinder 11, a dielectric 13, and a circular conductive path, such as a helically wound insulated wire 15. A section along the center line of the overmoded waveguide is shown in Figure 2.

The overmoded waveguide fabrication process comprises the steps of providing a collapsible mandrel upon which the insulated wire is helically wound, by use of a lathe, onto the collapsible mandrel; disposing the collapsible mandrel and helically wound insulating wire 15 assembly concentrically within an aluminum cylinder 11; injecting a liquid dielectric 13 in the space between the helically wound insulated wire 15 and the inner surface of the aluminum cylinder 11; curing the liquid dielectric 13; collapsing the collapsible mandrel and removing it from the inside of the helically wound insulated wire 15, dielectric 13, and aluminum cylinder assembly 11.

Advantages and Features

The overmoded waveguide fabrication process fabricates waveguides that approach the theoretically predicted performance and are relatively tolerant to imperfections. The fabrication method is simple while reducing costs and improving performance.

Navy Tech. Cat. No. 1130 Navy Case No. 71,126

NEW GENERATOR ADAPTER SPLINE REMOVER/ INSTALLATION TOOL FOR THE SH-2F HELICOPTER

Steve S. Floyd

Gulf Shores, Alabama

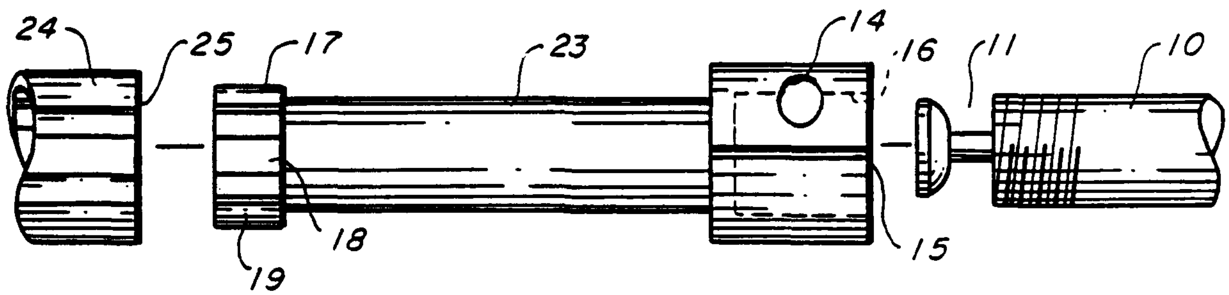

FIG. 1

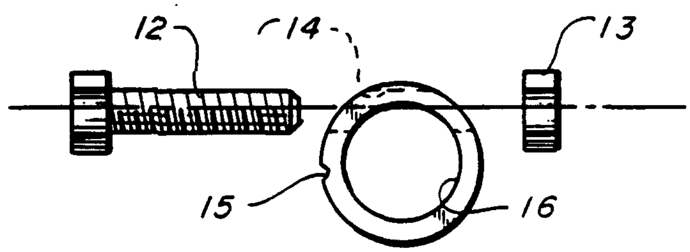

FIG. 3

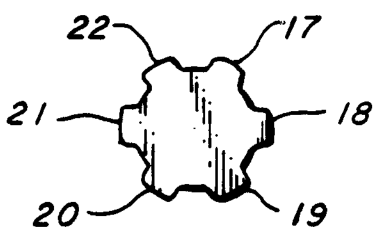

FIG. 2

Navy Tech. Cat. No. 1130 Navy Case No. 71,126

NEW GENERATOR ADAPTER SPLINE REMOVAL/ INSTALLATION TOOL FOR THE SH-2F HELICOPTER

Steve S. Floyd

Gulf Shores, Alabama

Abstract

An improved tool for the removal of generator adapter splines used in SH-2F aircraft is disclosed. The tool comprises a brass cylinder with raised grooves on one end and a coupling device on the other end, using a screw and nut. The tool is to be used in conjunction with the SH-2F IMRL tool which is still used for spline installation.

Description

Removal of the SH-2F generator adapter spline was originally performed by prying the spline out with a hammer and screwdriver, a task both difficult and time-consuming. The tool currently in use was designed to alleviate these problems. The aluminum tool consists of five parts, and costs $217.00. However, due to its design and material selection, the tool may damage the inside of the spline during removal.

FIG. 1, 2 and 3 illustrate an improved tool for spline removal which has been manufactured and used by HSL-32 Detachment 7. FIG. 1 shows the alignment of the new tool with a spline 24 and the IMRL tool 10. The new tool is machined from 0.750" round brass stock, alloy 360. A 0.500" diameter hole 16, drilled to a depth of 0.550", on e end of the tool is used to couple the tool with the IMRL tool 10. Six rounded grooves 17-22, shown in FIG. 2 are cut on the other end of the tool. The grooves have a width of 0.165", a length of 0.275", and a tooth-to-tooth diameter of 0.600". A cylindrical shaft 23, having a length of 1.750" and diameter of 0.475", is cut between the raised grooves 17-22 and the coupling device. The overall length of the tool is 2.665".

In FIG. 1, the tool is fastened to the IMRL tool 10 by inserting the end of the IMRL tool into the 0.500" diameter hole 16. Referring to FIG. 3, a 5/16" screw 12 is then placed through the drill hole 14 on the tool and secured with the nut 13. The center of the drill hole 14, as shown in FIG. 1, is positioned 0.275" from the right end and 0.150" below the top end of the tool. This drill hole 14 positions the screw in a ridge 11 on the IMRL tool, securing the tool while also allowing it to rotate.

The tool removes the spline 24 from the combining gearbox in the following manner. The tool is pushed through the inside of the spline until the raised grooves 17-22 pop free at the other end. The tool is then rotated until the groove on the tool 15 is aligned with a groove on the spline 25. The 1/32" groove 15 is cut on the 0.750" diameter portion of the tool and is aligned with the center of one of the grooves 18 on the opposite end of the tool.

This procedure positions the raised grooves on the tool 17-22 over the internal spline grooves. The spline is then removed by pulling up on the IMRL tool 10.

The spline can still be installed with the IMRL tool. Alternatively, a 1/3" portion of unusable spline with a washer glued to one end can be placed on the grooved end of the tool and can be used to push the spline into the gearbox in a manner similar to the IMRL tool.

Advantages and Features

The new tool was designed to avoid damage to the inside of the spline during removal. The tool accomplishes this by only applying pressure to the end of the spline inside the gearbox. The use of brass, a softer metal than aluminum, also helps to avoid damage to the spline.

A significant advantage of the new tool is its cost. The tool will cost less than $1.00 to produce, resulting in a savings of approximately $216.00 when compared to the tool currently in use. The new tool also only uses three parts as opposed to the five parts required for the present tool. The fewer number of parts makes the new tool easier to use and less susceptible to foreign object damage (FOD) to aircraft.

VARIABLE PITCH THRUSTER

Ronald C. Horn
Victor C. Anderson

UCSD, Scripps Inst., San Diego, CA

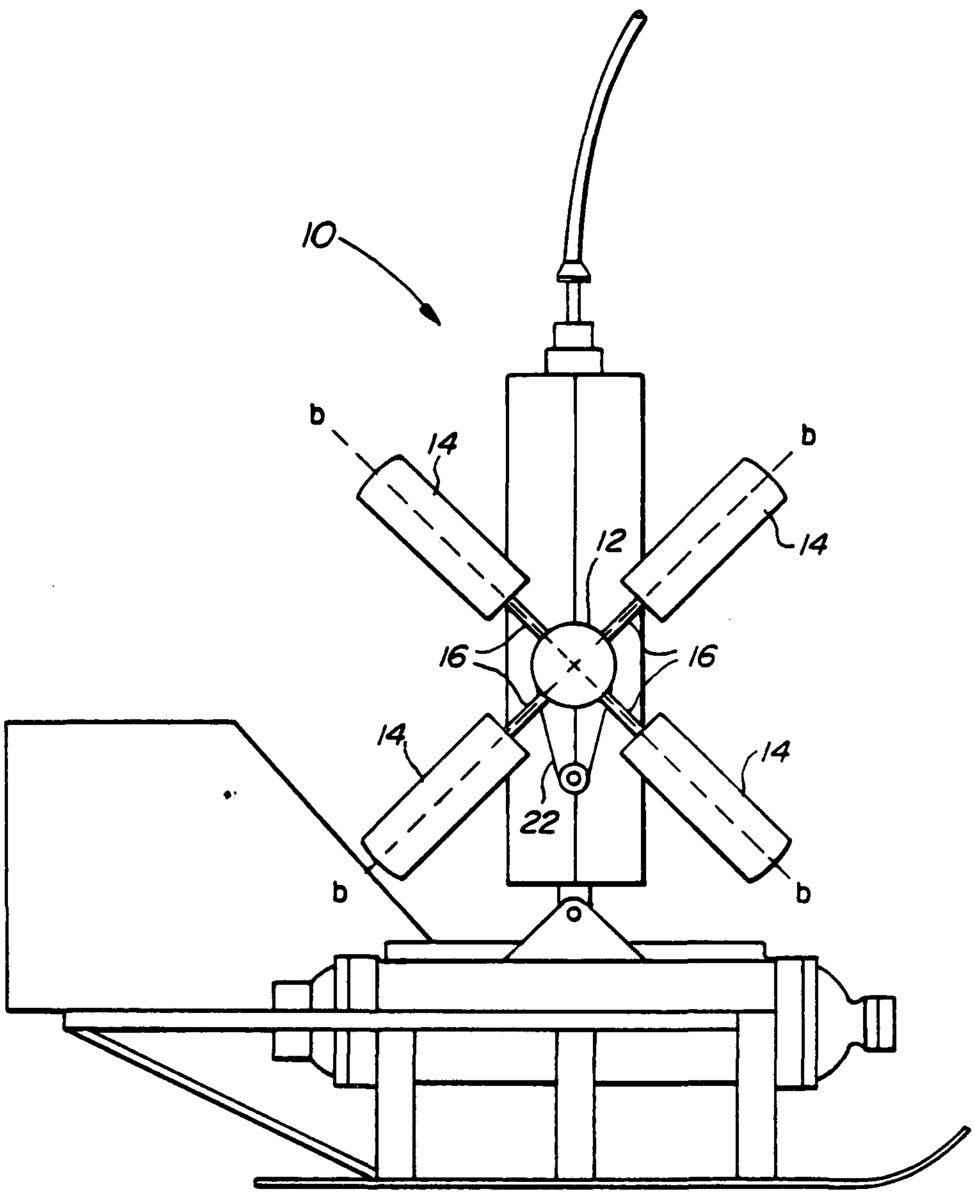

FIG. 1

VARIABLE PITCH THRUSTER

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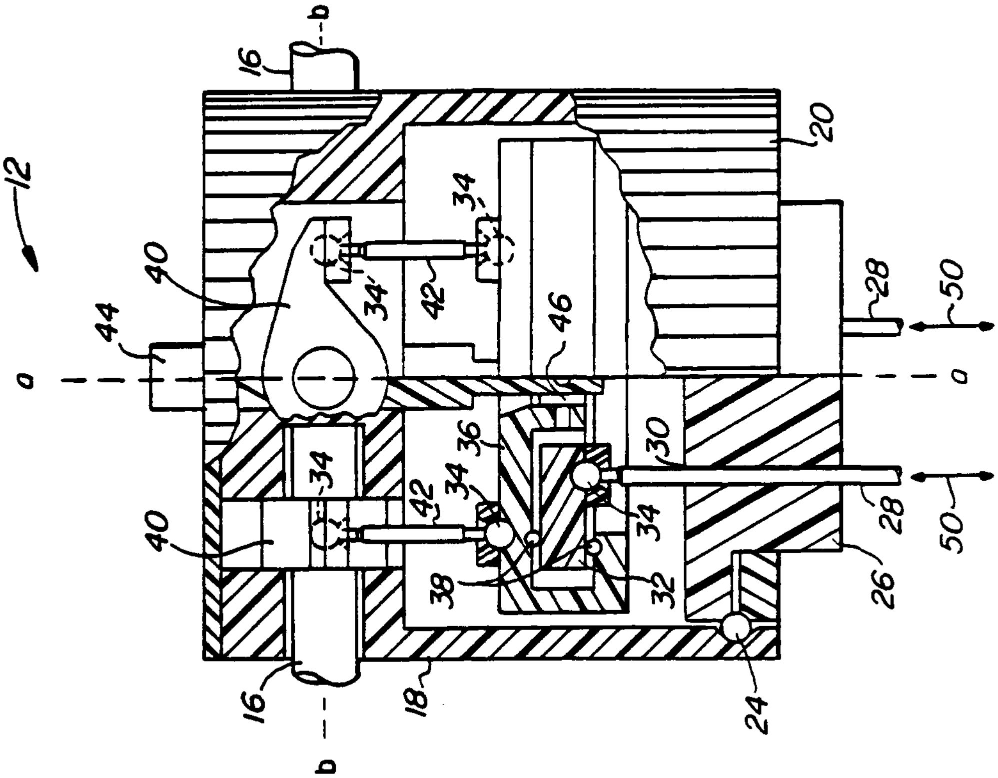

FIG. 3

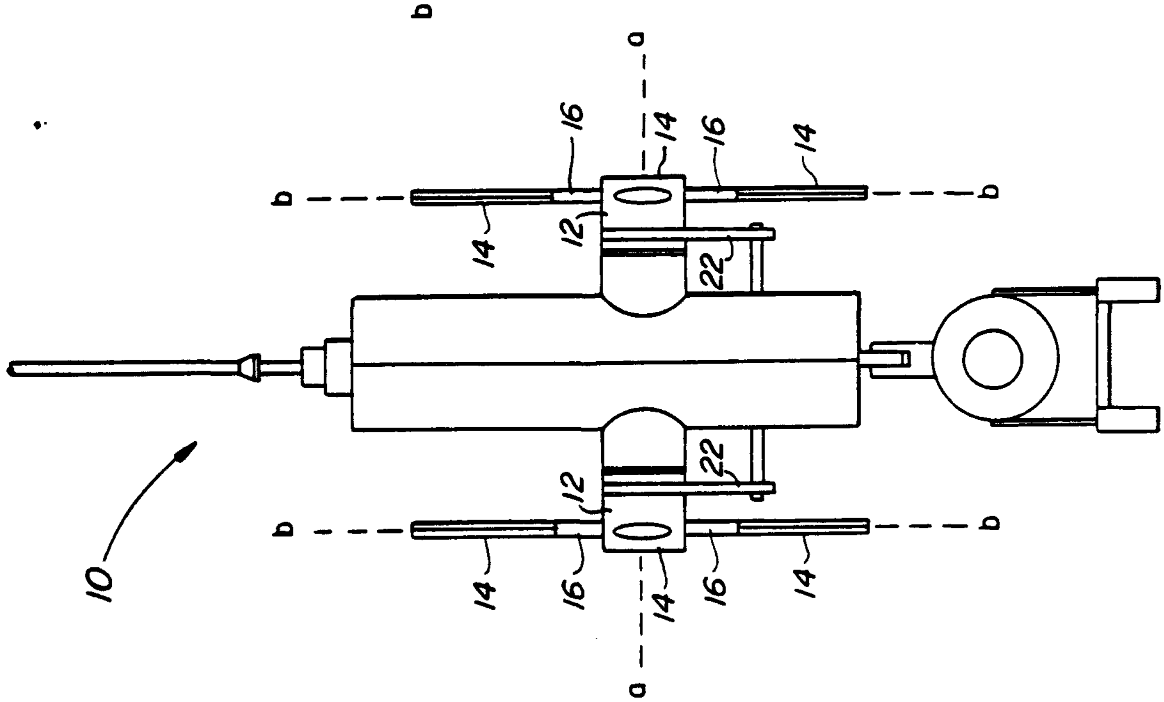

FIG. 2

VARIABLE PITCH THRUSTER

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Abstract

This device is an underwater variable thruster pitch mechanism which includes a control rod actuated wobble plate linked to a plurality of thruster shafts. The device provides bidirectional variable thrust along a thruster axis of rotation separately or in combination with variable torque perpendicular to that axis by changing the pitch angle of a plurality of thrusters.

Description

Elevation and profile views of underwater submersible 10 incorporating two variable pitch thruster mechanisms 12 are shown in Fig.'s 1 and 2, respectively. A cut-away view of variable pitch thruster mechanism 12 is depicted in Fig. 3.

Four symmetrical thrust blades 14 are separately and fixedly attached to four blade shafts 16 that rotate in conjunction with housing 18 about axis a-a. The exterior surface of housing 18 includes teeth 20 which are engaged by flexible toothed belt 22 shown in Fig.'s 1 and 2. The pitch of blades 14 may be varied by angularly displacing shafts 16 about their respective longitudinal axes, b-b. Housing 18 rotates about axis a-a on ball bearings 24 mounted between housing 18 and base 26, fixedly mounted to submersible 10.

Control rods 28 slide within bores 30 in base 26. Circular wobble plate 32 is linked to control rods 28 by spherical bearing joints 34. Circular follower plate 36 rotates on bearings 38 about wobble plate 32. Follower plate 36 is linked to rocker arms 40 by push rods 42. Spherical bearing joints 34 terminate each end of push rods 42 and attach the latter to follower plate 36 and rocker arms 40. Each rocker arm 40 is fixedly mounted to a thruster shaft 16 whereby this combination pivots about axis b-b.

Square shaft 44 is fixedly mounted between housing 18 and universal joint 46 which in turn is attached to follower plated 36. Square shaft 44 transmits torque from housing 18 to follower plate 36.

In the operation of the invention, flexible gear belt 22, driven by a motor, not shown, engages teeth 20 and imparts rotational motion about axis a-a to the assembly which includes housing 18, thrust shafts 16, rocker arms 40, and push rods 42. Torque transmitted by housing 18 through square shaft 44 and universal joint 46 causes follower plate 36 to rotate on bearings 32. The position of wobble plate 32 may be selectively varied.

However, wobble plate 32 does not rotate.

Varying the pitch and hence the thrust and torque outputs of thrust blades 14 is accomplished by actuating control rods 28 in the directions of arrows 50 shown in Fig. 3. Control rods 28 are actuated by well known techniques not described within this paper. Actuation of control rods 28 causes wobble plate 32 to change position which may be a combination of tilting and translation. Follower plate 36, which is constrained to rotate around wobble plate 32, also changes its position similarly, causing push rods 42 to either push or pull on rocker arms 40. The angular orientation of shafts 16 about axes b-b, and hence the pitch of thrust blades 14, changes with respect to housing 18 in response to actuation of rocker arms 40.

With respect to a common starting point as a frame of reference, moving control rods 28 an equal amount in the same direction changes the pitch of each thruster blade 14 an equal amount. This produces a change in the thrust output of thruster blades 14. Unequal actuation of control rods 28 causes wobble plate 32 to tilt. This causes the pitch of each blade 14 to vary as blades 14 rotate about axis a-a of housing 18. This produces a change in the torque output of thrust blades 14. A combination of thrust and torque outputs are available through appropriate actuation of control rods 28.

Navy Tech. Cat. No. 5382 ____ Navy Case No. 69632

Advantages and Features

The conventional system for controlling the motion of underwater robotic vehicles requires six or more thruster mechanisms to provide torque and thrust for adequate position control. The variable pitch mechanism described in this paper provides the same degree of position control as the conventional system but with only two variable pitch thruster mechanisms.

COMBINATION VACUUM AND GRAVITY FLUSH WATER CLOSET

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Edward W. Pennington, Alexander E. Laidis
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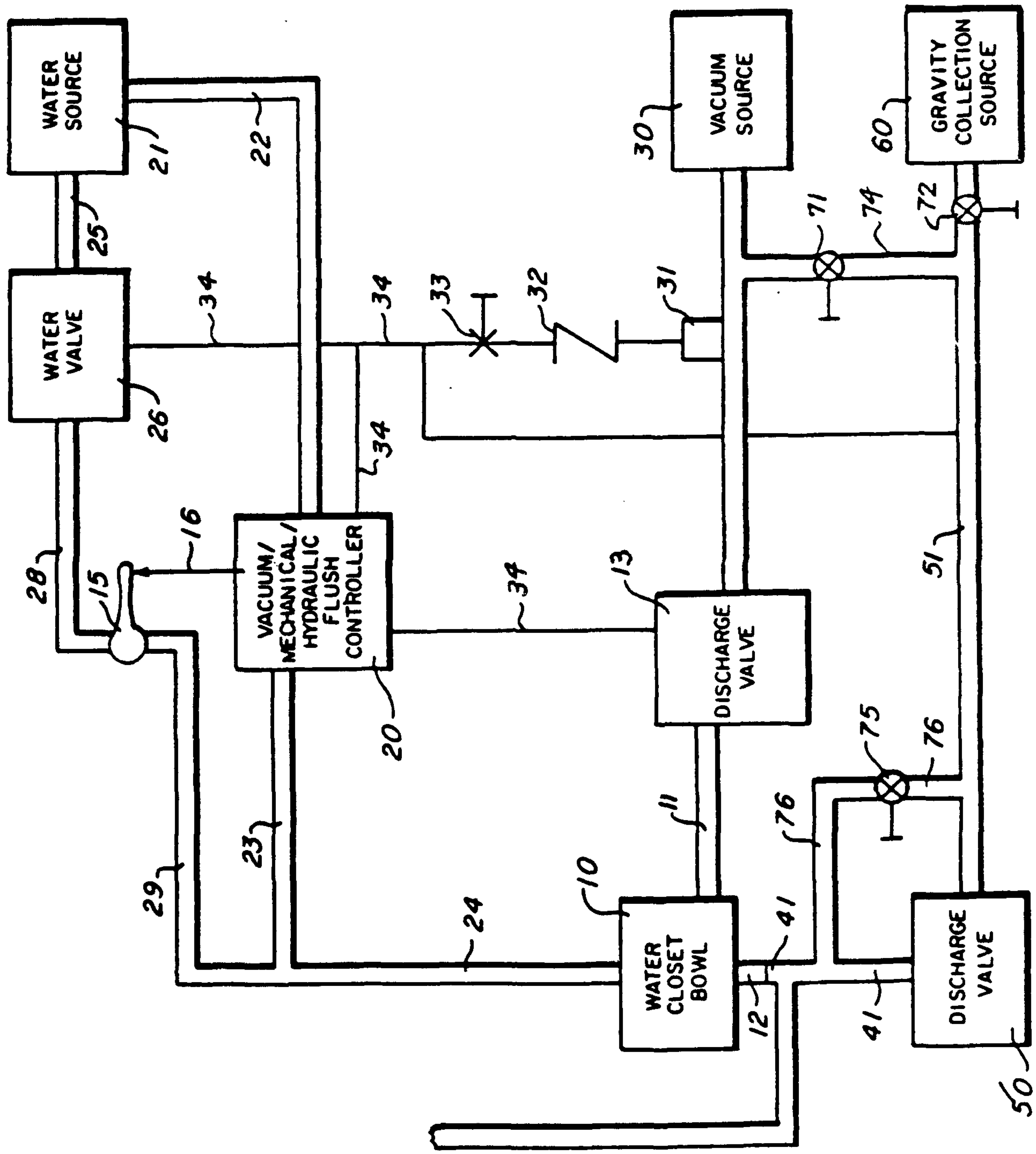

Navy Tech. Cat. No. 79 40 Navy Case No. 68046

COMBINATION VACUUM AND GRAVITY FLUSH WATER CLOSET

Milton W. Raupuk, Jr.
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Abstract

The operational availability and reliability of a vacuum-operated water closet system is enhanced by incorporating a gravity-operated backup system. The vacuum-operated system and the gravity-operated systems are independent waste evacuation systems except for a common water source, manual flushometer, and water closet.

Vacuum source loss; due to such occurrences as a malfunction, loss of electrical power, or manual closing of a vacuum control isolation valve; inactivates the vacuum-operated system by disabling a flush controller and a vacuum discharge valve. Simultaneously, vacuum source loss activates the gravity-operated system by enabling a water valve and a gravity discharge valve. Activating the manual flushometer causes the water closet bowl to function as a gravity waste evacuation system.

Description

A water closet bowl 10 is fabricated to include two waste-water discharge connections, one for vacuum transport 11 and another for gravity transport 12. The vacuum connector

11 is mated directly to the inlet of a pneumatically-triggered water closet discharge valve 13 which is normally closed. When the handle on a manual flushometer 15 is despressed or lifted, a connecting rod assembly 16 pushes or pulls a plunger on a normally-closed vacuum switch of a vacuum/mechanical/ hydraulic water closet flush controller 20. This action energizes the controller's circuit. The controller's flushing water timer is activated causing water from the water source 21 to flow through conduits 22, 23, 24 into the water closet bowl. Water flow through the manual flushometer 15 into the water closet bowl 10 is prevented by a normally-vacuum-closed water valve 26. Flush water continues to flow while a discharge timer, also part of the controller 20, activates and directs vacuum tapped off a vacuum source 30 (typically a vacuum collection tank) through a connector tap 31, check valve 32, normally-open insolation valve 33, and tubing 34 to open a pneumatically-triggered discharge valve 13 This permits the flow of wastewater from the water closet bowl 10, through the discharge valve 13, and into a vacuum collection tank 30 due to the air inrushing into the water closet bowl 10. Gravity discharge from the water closet bowl 10 is prevented by a normally-vacuum-closed discharge valve 50. When the controller's discharge timer times out, the discharge valve 13 closes. Water continues to flow into the bowl until the controller's water timer deactivates,

leaving a small amount of water in the water closet bowl 10 and completing the vacuum flush cycle.

On a loss of vacuum supply or by closing a vacuum control isolation valve 33, the pneumatically-triggered discharge valve 13 is disabled and valves 26 and 50 open. When the manual flushometer 15 is flushed, a controlled volume of water from the water source 21 flows through conduits 25, 28, 29, 24 into the water closet bowl. Water flow through the water closet controller 20 is inhibited by a loss of vacuum. Wastewater from the water closet bowl 10 flows due to gravity through gravity connector 12, through drain lines 41, 51, to a gravity collection source 60. Isolation valves 71, 72 and drain line 74 may be provided to allow wastewater to be diverted to either the vacuum collection tank 30 or the gravity collection source 60. Also, discharge valve 50 may be paralleled with a manual valve 75 and drain line 76 if it is desired to bypass valve 50.

Advantages and Features

This water closet retains all the known advantages of reduced-volume, vacuum operated water closets; such as use of small diameter drain piping, obviation of sloping run requirements, and elimination of inside to outside line leakage; while eliminating such water closet's major limitation; preclusion of flushing by a loss of vacuum.

Navy Tech. Cat. No. 5901, 7802 Navy Case No. 70219

GAS AUTOMATIC SHUT-OFF VALVE WITH TIMER

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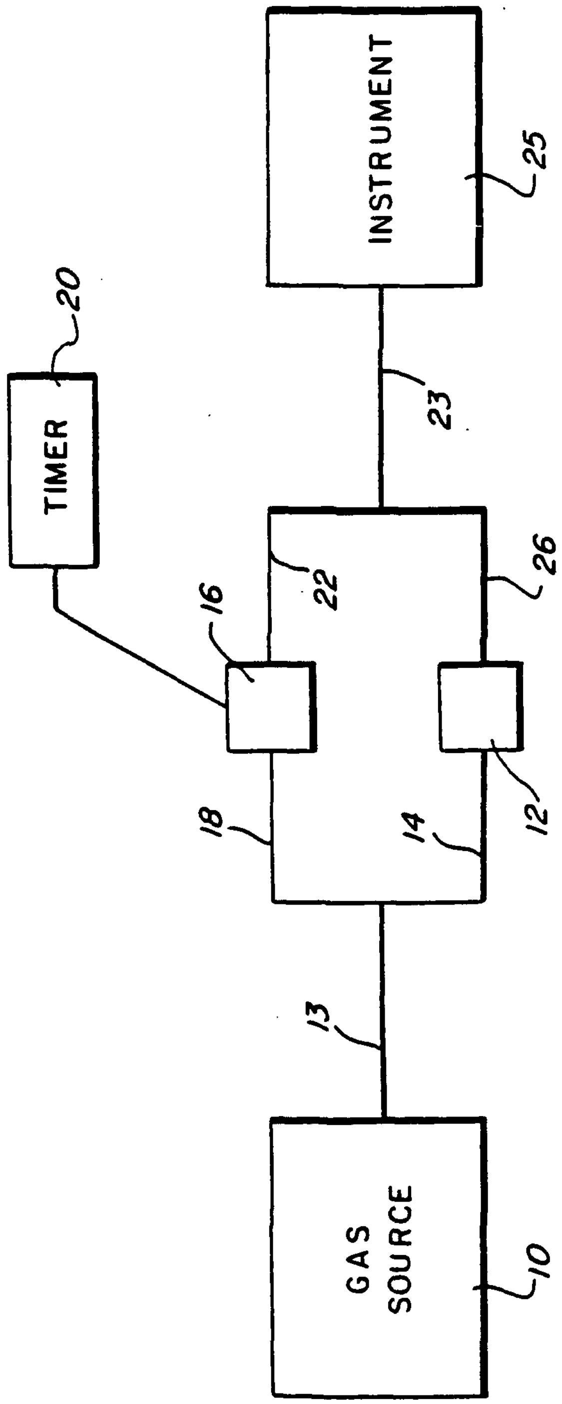

Navy Tech. Cat. No. 5901 7802 Navy Case No. 70,219

GAS AUTOMATIC SHUT-OFF VALVE WITH TIMER

Keane T. Suzuki

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Abstract

This device, which includes manual and solenoid operated gas valves and an electric timer actuator, allows for the automatic shut-off of an unattended gas line at a predetermined time.

Description

For many analysis purposes, a specialty gas is needed. The duration of an analysis may be as short as a few minutes or as long as several hours or more. For long analyses, it is not practical for an analyst to continually monitor the situation in tests where constant monitoring is not required. An analyst who uses a specialty gas is faced with two problems: (1) the supply of specialty gas will be depleted much sooner if no one is available to shut off the supply; and, (2) it will take much longer to complete a set of samples if the analyst chooses to start a procedure only when someone is available to continually monitor the test. A tank of specialty gas can last several times longer using the present automatic shut-off device.

There are many automatic shut-off valves available for other purposes. Most of these safety valves are activated by sensing a change in pressure, heat, or motion, or when a contaminant is found in a system. These valves are quite common and mostly designed for large gas volumes and flow rates. Another type of control system is a timed gas switching box, which will switch different purge gasses at a preset time. In these switching systems the gas flow is merely diverted to atmosphere when it is not being used, the timing is very limited, and there is a continual gas drainage, thus providing no economic advantage.

The proposed device is not a check valve, but a valve which optimizes efficiency and productivity, without risking safety. A schematic diagram of the present gas automatic shut-off valve, as typically used in a system, is shown in the figure of drawing. Shown, are a gas source 10 connected to a manually operated valve 12 via appropriate tubing or pipe gas lines 13 and 14, and to an electrically operated valve 16, for example, via gas lines 13 and 18. Valve 16 is a normally off, zero leak, solenoid operated valve. A timer 20 is connected to valve 16 to actuate the valve to shut-off at a predetermined time. Gas lines 22 and 23 connect the solenoid operated valve 16 to an analysis instrument 25, and gas lines 26 and 23 connect manually operated valve 12 to the analysis instrument. The tubing or pipe lines are of the same size, and the total length of gas lines 14 and 26 equal the total length of gas lines 18 and 22 to prevent a flow discrepancy that could arise from having unequal lengths of pipe line.

Operation: The manually operated valve 12 is normally used when the system is attended; this prevents overworking of the solenoid valve 16. When analyses are being made and the system needs to operate unattended, the timer device 20 is set to the desired shut-off time and valve 16 is turned on. Manually operated valve 12, if already open, can then be turned off without causing a break in the gas flow between the gas source and analysis instrument 25. At the predetermined time set on the timer device 20, the solenoid operated valve 16 will shut off the gas flow, thereby preventing waste of gas.

Advantages and Features

This device will shut off a gas line at a predetermined time. It allows a worker to start an analysis and leave the test site without having the gas flow continue once the test is over. The worker is free to direct his attention elsewhere.

Use of this system improves the efficiency of personnel and materials, increases productivity, and reduces cost of materials and manpower, without risking safety.

COMPACT CABLE TERMINATION

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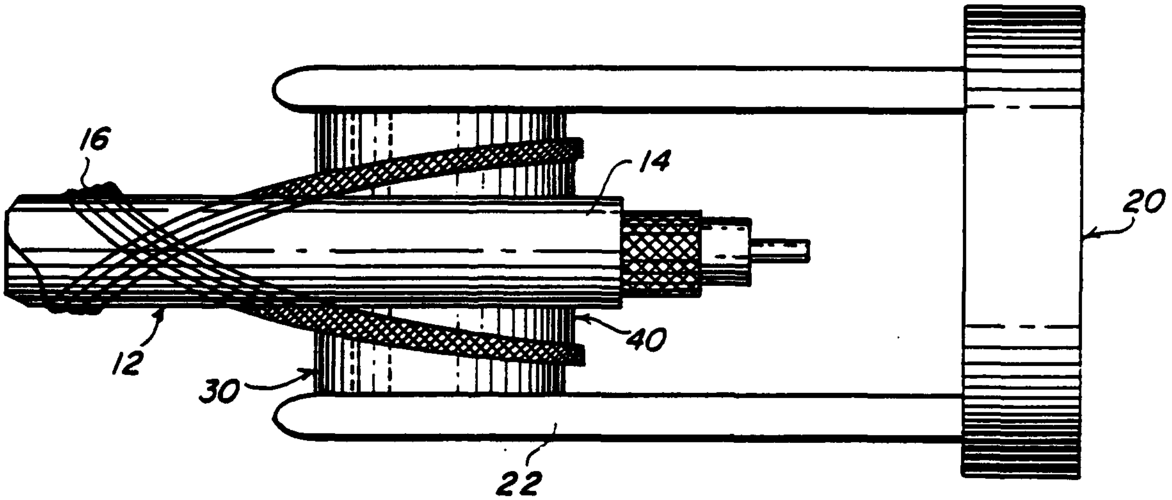
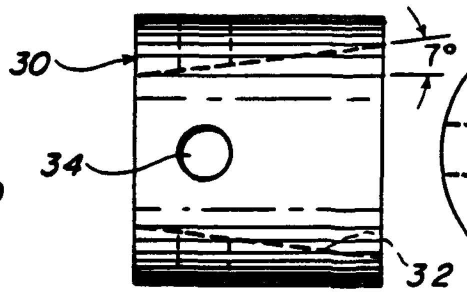


FIG. 1

FIG. 2



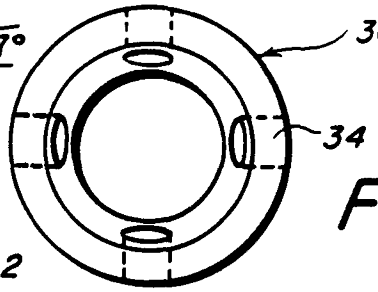
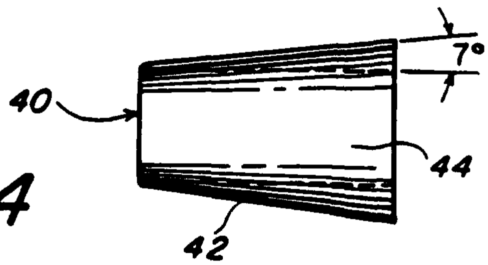


FIG. 3

FIG. 4



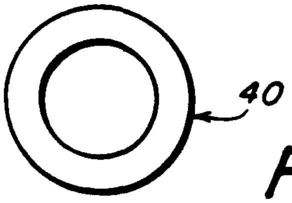


FIG. 5

Navy Tech. Cat. No. 1531 1551 Navy Case No. 70367

COMPACT CABLE TERMINATION

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Abstract

A device used to mechanically terminate an armored coaxial cable in a watertight and pressure resistant manner. The device is a component assembly adapted to a lightweight, compact and fully coaxial mechanical end structure for commonly used braided, coaxial armored cable.

Description

Is is well known that electrical cables for undersea application may incur severe operating problems or complete malfunctions when not properly waterproofed and pressure protected. Particularly susceptible to water intrusion are those end portions of a cable that, for various reasons, must temporarily be disconnected or otherwise terminated yet must remain in the hostile undersea environment.

The mechanical termination device according to the presnt preferred construction is shown in Fig. 1 where it is located on an end portion of a braided coaxial cable 12. The device consists of three distinctly configured elements: a removable pressure case end-cap 20; an outer cylinder 30; and a hollow frustum of a cone 40.

Fig. 2 is a side view of the outer cylinder 30 manufactured to include a 7-degree tapered interior bore 32 with circumferentially spaced holes 34 extending radially from the interior bore to the outer surface of the cylinder.

Fig. 3 is an end view of the outer cylinder 30. The circumferentially space holes 34 are adapted to receive roll pins (not shown) to assist in securing the end cap 20 to the outer cylinder 30.

Fig. 4 is a side view of the hollow frustum of a cone 40. The other surface 42 of the cone is tapered to match the 7-degree taper of the interior bore 32. The bore 44 of the cone 40 is just sufficiently larger than the jacket 14 on the coaxial cable 12 to allow the cone to slide into position on the cable jacket. The small end of the frustum must approach the cone bore diameter closely to prevent a sharp bend in the armor wires 16 as tension is applied and the cable tends to reduce in diameter as the end cap is put into place.

In employing the termination device, glue is applied to the cable jacket 14 and the cone 40 is placed as shown in Fig. 1 under the braided armor. Glue is then applied to the braided cable above the cone 40 and ther outer cylinder 30 is seated with considerable force and held in place until the glue cures.

The outer cylinder and inner cone assembly is then inserted into a tubular protrusion 22 of the pressure end cap 20 and is held in place by roll pins (not shown). The coaxial cable is thereby terminated by a waterproof and pressure resistnat connection through the end cap. The use of a steeper taper than other conventilonal terminations makes the shortness of the described termination possible. A braided armor is required to properly use this technique. A longer taper is needed if double lay armor is used.

Advantages and Features

The advantages of this termination technique are that it is compact, lightweight and economical. Using the technique as above described will result in a shorter, less bulky terminating assembly that is completely waterproof and pressure resistant. The device is suitable for all commonly used armored coaxial cables.